

DPM66

Meter of eyepiece diopter power



Fig. 1. DPM66 meter: a) drawing, b) work diagram

1 Why eyepiece diopter power is important?

A series of direct view optical/electro-optical devices (binoculars, telescopic sights, night vision/thermal monoculars/goggles/binoculars) project image of scenery of interest into direction of an eye of the observer through an optical ocular. Human observer can perceive sharp image even when having refractive eye defects (short-sightedness or long-sightedness) due to possible regulation of diopter power of the eyepiece (rotation mechanism with a dioptic scale on the eyepiece). This scale gives indication on diopter power of refractive eye defect of human observer that the eyepiece is optimized (typically in range +6D to -6D).

Improper setting of diopter power of eyepiece of direct view imager can lead to sight fatigue, strong headache of the human observer and possible different negative consequences. Therefore accurate scale of eyepiece diopter power of eyepiece is important for safe use of direct view imagers. However, accurate measurement of diopter power of eyepieces is difficult and it is quite common to find on international market devices with different non-proper diopter scale even in case of highly reputable vendors. The consequences are quite serious. Users of direct view devices having cannot fully trust the dioptric scale and determine optimal rotation of the ocular by themselves losing time and risking choosing wrong setting or have increased discomfort of observation when using recommended diopter setting. Therefore requirements on eyepiece diopter are typically presented in specifications of direct view imagers and are supposed to be checked during acceptance or maintenance tests.

2 What is DPM66?

DPM66 is a meter of dioptric power of oculars of optical/electro-optical devices (binoculars, telescopic sights, night vision/thermal monoculars/goggles/binoculars). In detail, DPM66 meter determines optical power of corrective lens that simulates the same image distance for a human observer during ophthalmology test as eyepiece when the same human is using direct view imager.

3 How it works?

From design point of view DPM66 can be treated as electronic simulator of human eye of variable refractive eye defects. It is built a calibrated variable focus electronic camera combined with laptop and suitable software. This simulator can generate sharp image only when diopter power of tested eyepiece equals to simulated power of refractive eye defect. Its user can regulate level of simulated refractive eye defect of the observer in range from +6D to -6D using a manual rotation knob on a backwall and a diopter scale on the top wall of this device. The measurement is done by regulating simulated refractive eye defects and finding setting when DPM66 generates the sharpest image at its electronic output. User can see image perceived by DPM66 meter at different setting of simulated eyepiece diopter when the meter is connected to any tablet/laptop/PC having USB input port. Image sharpness is evaluated subjectively by human observer or with support of Inframet software.

DPM66 meter can work only when it can detect some imager projected by eyepiece of tested direct view imager. If software to analyse output image from DPM66 is to be used to determine eyepiece diopter then it is recommended to use professional image projector that projects at infinity distance an image of an edge target. If output image from DPM66 presented on laptop display is to be analysed subjectively by a human observer then it is recommended to use the image projector that projects an image of a resolution target (for example USAF1951 target). However, it should be noted that the image projector (typically set of collimator, wheel with target, set of targets, radiation source) is an optional block. DPM66 can be used also to analyse images from tested imager looking on any target within imager focus range and to measure eyepiece diopter of such an imager.

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4 Special features

High accuracy of determination of eyepiece diopter power of direct view imagers has been achieved by use in DPM66 meter imaging optics of very short focusing depth. It means that DPM66 meter can generate sharp image generated by tested direct view imager only when eyepiece diopter power of this imager exactly equals to value indicated at its dioptric scale. It is a sharp contrast to typical low cost meters of eyepiece diopter power that works as small refractive telescopes built using optics of long length and capable to generate quite sharp image even at moderate differences between eyepiece diopter power of tested imager and its values indicated at dioptric scale of the meter.

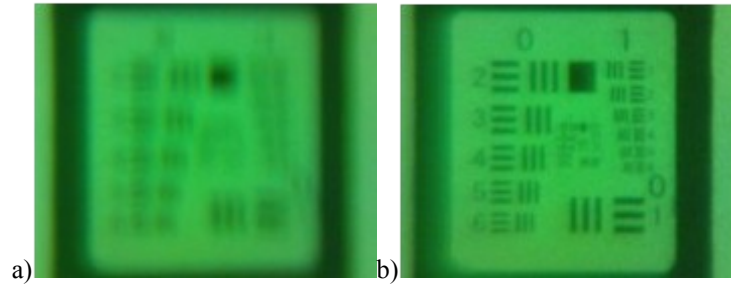


Fig. 2. Image generated by DPM66 during measurement of diopter power of a night vision device; a) image generated by DPM66 simulating diopter power of refractive defects of human observer that differs from eyepiece diopter, b) image generated by DPM66 simulating diopter power of refractive defects that equals to eyepiece diopter of tested NVD

5 Blocks of DPM66

DPM66 is delivered as a set of blocks:

1. DPM66 meter
2. USB cable
3. SHARP computer program.

SHARP is a computer program working under Windows operating system that:

1. enables visualization of image perceived by DPM66 meter
2. works as evaluator of sharpness of image perceived by DPM66 meter.

6 Versions

DPM66 can be delivered in two versions:

1. DPM66 – standard version for work in laboratory conditions
2. DPM66-AT – athermalized version designed for operation in extreme temperature conditions: -20°C to $+55^{\circ}\text{C}$.

7 Technical specification

Parameter	Value
Range of measurement of diopter power of optical oculars	+6D to -6D
Calibration uncertainty of the meter scale	0.1D
Measurement sensitivity*	$\pm 0.1\text{D}$
Output port	USB2.0
Software operating system	Windows 7/10/11
Operating temperature range	+5°C to +35°C – standard version - 20°C to +55°C – athermalized version (AT)
Storage temperature range	-5°C to +55°C – standard version - 20°C to +70°C – athermalized version (AT)

* - range of regulated simulated eyepiece diopter when output image looks similar and the meter treats that eyepiece diopter is constant

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8 WHY DPM66?

DPM66 meter is the first commercially available professional electronic meter of optical power of direct view optical/electro-optical devices offered on international market. Its accuracy significantly exceeds accuracy of typically used simple optical telescopes of variable dioptric power. DPM66 can significantly improve comfort of use of optical/electro-optical devices manufactured for direct view by human observers having refractive eye defects.

Version 2.3

CONTACT:

Tel: +48 22 6668780

Fax: +48 22 3987244

Email: info@inframet.com

Version 2.2